แนวโน้มการวิจัยของมหาวิทยาลัยเทคโนโลยีราชมงคลศรีวิชัย:
การวิเคราะห์บรรณมิติและนำเสนอแผนภาพ
Rajamangala University of Technology Srivijaya Research Trends: Bibliometric and Visualized Analysis

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บทคัดย่อ

บทความนี้มีวัตถุประสงค์เพื่อวิเคราะห์บรรณมิติในการสำรวจและตรวจสอบผลงานวิจัยของมหาวิทยาลัย เทคโนโลยีราชมงคลศรีวิชัย โดยนำชุดข้อมูลการวิจัยมาจากฐานข้อมูล Scopus และกำหนดช่วงเวลาตั้งแต่ปี 2005 ถึง 2022 ทำการวิเคราะห์ข้อมูลโดยใช้ซอฟต์แวร์ *VOSviewer* และ *Bibliometrix* และสร้างแผนที่ความรู้แบบกราฟิก มีการตรวจสอบการเปลี่ยนแปลงในแต่ละปีของการตีพิมพ์เผยแพร่ *h-index* ผลงานร่วม และจุดเด่นของงานวิจัย ทั้งหมด 524 ฉบับ ผลการวิจัย พบว่า การตีพิมพ์เผยแพร่ผลงานวิจัยมีจำนวนเพิ่มขึ้นในช่วงเวลาที่ทำการศึกษา ผลงานวิจัยส่วนใหญ่เป็นด้านวิทยาศาสตร์การเกษตรและชีวภาพ แนวโน้มของหัวข้องานวิจัยได้แก่ Internet of Things, Transmission electron microscope, Water quality, Wood plastic composite และ Microstructure การศึกษา นี้มีประโยชน์สำหรับนักวิจัยในแง่ของการระบุสถานการณ์การวิจัยในปัจจุบัน แนวโน้ม และการพัฒนาการวิจัยและ พัฒนาของมหาวิทยาลัยเทคโนโลยีราชมงคลศรีวิชัยในอนาคต

คำสำคัญ: มหาวิทยาลัยเทคโนโลยีราชมงคลศรีวิชัย, ผลิตภาพการวิจัย, แนวโน้มการวิจัย, การวิเคราะห์บรรณมิติ, โปรแกรม Biblioshiny, โปรแกรม VOSviewer

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สาขาการจัดการนวัตกรรมและสารสนเทศทางธุรกิจ คณะเทคโนโลยีการจัดการ มหาวิทยาลัยเทคโนโลยีราชมงคลศรีวิชัย อำเภอทุ่งสง จังหวัดนครศรีธรรมราช 80110

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ABSTRACT

The purpose of this paper is to use bibliometric analysis tools to explore and examine the research productivity for Rajamangala University of Technology Srivijaya. The research data sets were obtained from the Scopus database, and the time period was set from 2005 to 2022. The data were analyzed by means of *VOSviewer* and *Bibliometrix* software, and graphical knowledge maps were created. It looked at how publications, distribution, h-index, co-authorship, and research hotspots have changed annually. Five hundred twenty-four publications altogether were attained. The findings indicated an increase in the number of research publications during the study period. Most of them were from agricultural and biological sciences. Internet of things, transmission electron microscope, water quality, wood plastic composite and microstructure were the trend topics. The study is helpful for researchers in identifying current research contexts, trends, and the future research and development directions of Rajamangala University of Technology Srivijaya.

Key words: Rajamangala University of Technology Srivijaya, Research productivity, Research trends, Bibliometric analysis, Biblioshiny, VOSviewer

INTRODUCTION

Thailand's economy is in serious peril. To recover quickly from the Covid-19 epidemic, the government must invest in Research and Development (R&D) and allow innovation to lead the way. R&D must receive adequate financial assistance from the government in order to propel the economy with innovations. R&D programs must also meet the actual demands of industry. Thailand's gross R&D expenditure from both the public and commercial sectors in 2018 was barely 1.11 percent of GDP, or roughly 182 billion baht. According to UNESCO, this expenditure was lower than that of other nations in the same upper-middle-income category, which was 1.41 percent of GDP. Meanwhile, high-income nations spend twice as much on R&D, accounting for 2.43 percent of GDP.

Rajamangala University of Technology Srivijaya (RUTS) is one of the universities in the group of Rajamangala University of Technology. RUTS creates practitioners with the potential to succeed in the workplace and utilizes information intelligently to attain their own goals while meeting societal standards. RUTS has the objective to develop organizations and society in the region and country by applying science, technology, and innovation under the vision "The University of Innovation for Society". The vision aims to produce professional practitioners in order to be a standardized labor force that generates high income and increases the country's competitiveness at the international level (Rajamangala University of Technology Srivijaya, 2022).

Bibliometric analysis is becoming an increasingly important part of the evaluation methods available to R&D policymakers to help them make decisions (Isamail *et al*., 2012). Its popularity has grown in recent years, and this may be attributed to the innovation, availability, and usability of bibliometric tools like RStudio, Sci2, *Bibliometrix* (Aria and Cuccurullo, 2017), *VOSviewer* (Van Eck and Waltman, 2010), and scientific databases like Scopus and Web of Science, and cross-disciplinary bibliometric technique pollination from information science to research. The methodologies for bibliometric analysis are divided into two categories: performance analysis and scientific mapping (Naveen *et al*., 2020; Naveen *et al*., 2021a; Muhammad *et al*., 2021). Performance analysis investigates the contributions of research elements to a certain field (Cobo *et al*., 2011; Antonio-Rafael and Jose, 2004). Descriptive analysis is the characteristic of bibliometric investigations (Naveen *et al*., 2021b). Science mapping looks at the relationships between research aspects (Kent *et al*., 2021;

Cobo *et al*., 2011; Antonio-Rafael and Jose, 2004). The examination focuses on the intellectual exchanges and structural connections that exist between research parts. Methodologies utilized in scientific mapping include citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis (Kent *et al*., 2021; Dirk and Marc, 2018).

However, from a scientific point of view, based on a literature review, only a few authors have attempted to make efforts in exploring and examining the research productivity based on the available data from the Scopus database. Therefore, in order to complement the previous research, this paper aims to provide an overview of the research productivity with a study case in RUTS by using bibliometric methods.

MATERIALS AND METHODS
1. Data Collection Method

The process of this exploration started by using affiliations 'Rajamangala University of Technology Srivijaya' (Affiliation ID: 60092137) as the main keyword in the Scopus database. Following this, the result phase was able to retrieve a total number of 524 documents that were published between 2005 and 2022 (June 2022). This study focused on various aspects which include looking at citation information, bibliographical information, abstract and keywords, and funding details.

2. Data Analysis Method

For data analysis, all information was exported in BibTeX format. *VOSviewer* software and *Bibliometrix*, an R-tool for comprehensive scientific mapping analysis software, were utilized to analyze the data and create graphical knowledge maps. Annual changes in publications, distribution, h-index status, co-authorship status, and research hotspots were examined

RESULTS AND DISCUSSION

The bibliometric analysis of our study is divided into 6 categories which also carry multiple sub-categories. The main categories are: 1) Forms of publications, 2) Documents by subject area, 3) Sources, 4) Authors, 5) Topics trends, and 6) Countries. The sub-categories developed under Authors were: Most Relevant Authors, Top-Author's Production over the Time, and Collaboration Network. Their findings are important because they generate the bibliometric information which can be used to unravel high impact research that contributes to generating new knowledge at RUTS. The data extracted from the Scopus database comprise 524 articles and 305 authors published between 2005 and 2022 (June 2022).

1. The Main Information about the collection
### Forms of publications

Overview of publications on Scopus provides information to analyze different document types. It elaborates on the outcomes according to placements. In this context, the article is observed to have a total of 418 documents, marking the highest count among the various categories. Following this, conference papers account for 102 documents, while notes and book chapters have 3 and 1 document, respectively.
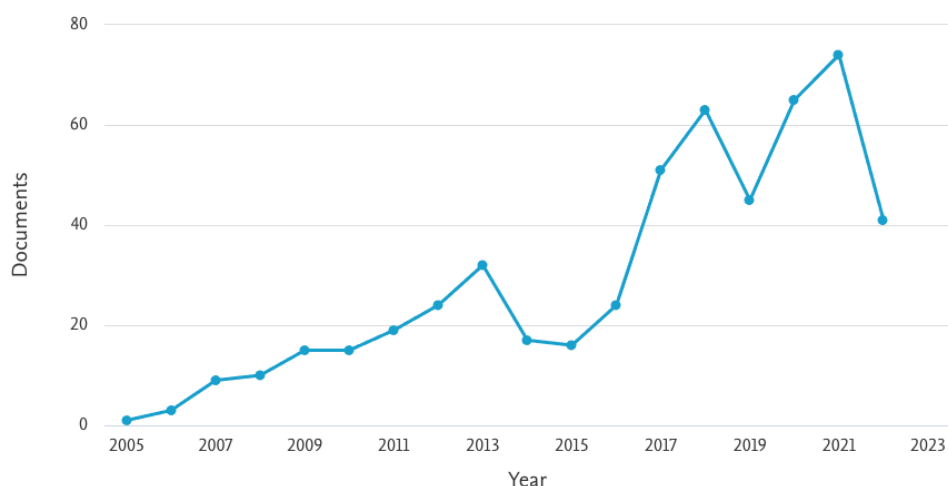
Figure 1 Number of documents published per year

As seen in Figure 1, the documents were published the most in 2021, followed by 2020 and 2018. The chart in Figure 2 shows that Songklanakarin Journal of Science and Technology (SJST) stands in the first place chosen by RUTS researchers to publish their papers. SJST has been published by the Research and Development Office, Prince of Songkla University, Thailand with high-quality scientific papers since 1979.

The journal provides an interdisciplinary platform for the dissemination of current knowledge and advancement in science and technology. Besides SJST, this can see the top-five yearly documents per year: the International Journal of Agricultural Technology, Walailak Journal of Science and Technology, Advanced Materials Research, Acta Horticulturae, and Advanced Materials Research.
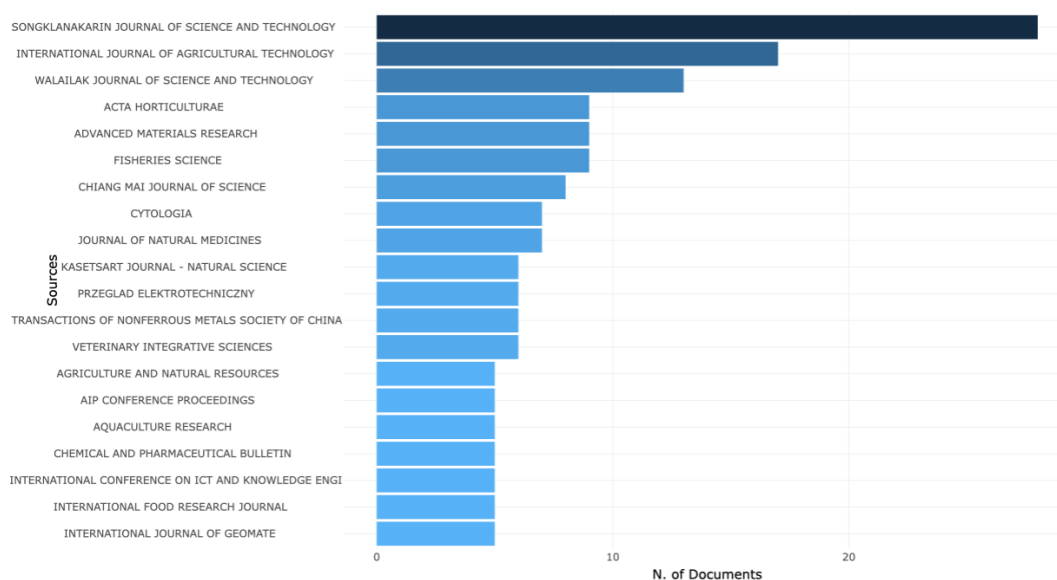

Figure 2 Most Relevant Sources

Documents by subject area

The subject area involved in RUTS research is demonstrated in Figure 3. As expected, the subject area that received more attention from researchers was 'Agricultural and Biological Sciences', which marked 177 articles. Additionally, the subsequent subject areas of interest are 'Engineering' and 'Biochemistry, Genetics and Molecular Biology' and 'Computer

Science'. In viewing the agricultural and biological sciences area, the researchers focused on veterinary, environmental science, and earth and planetary sciences subject areas. It is noted that some authors published articles in the area of Energy, Mathematics, Pharmacology, Toxicology and Pharmaceutics and Social Sciences (21.5%).
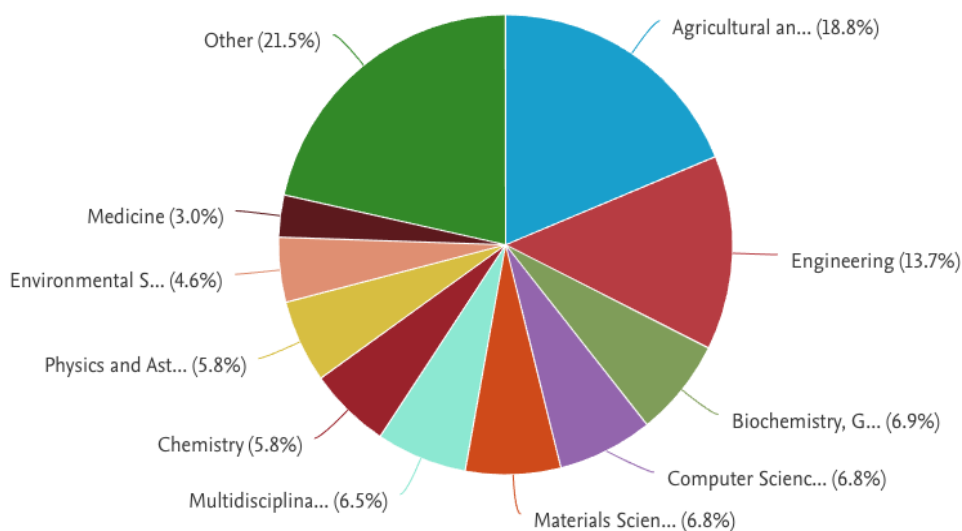

Figure 3 Documents by subject area

Source Impact

　　　　H-index is considered as one of the important indicators for the influence and reputation of journals. As visualized in Figure 4, Fisheries Science was the journal that ranked with the highest H-index at 7, followed by Journal of Natural Medicines (6), Transactions of Nonferrous Metals Society of China, and Chemical and Pharmaceutical Bulletin (5). Other journals with the lowest H-index indicator were Songklanakarin Journal of Science and Technology, International Journal of Agricultural Technology, Walailak Journal of Science and Technology, Advanced Materials Research, Kasetsart Journal – Natural Science, Agriculture and Natural Resources, Scienceasia, Bioorganic and Medicinal Chemistry, Journal of Experimental Marine Biology and Ecology, and Phytochemistry Letters (3).
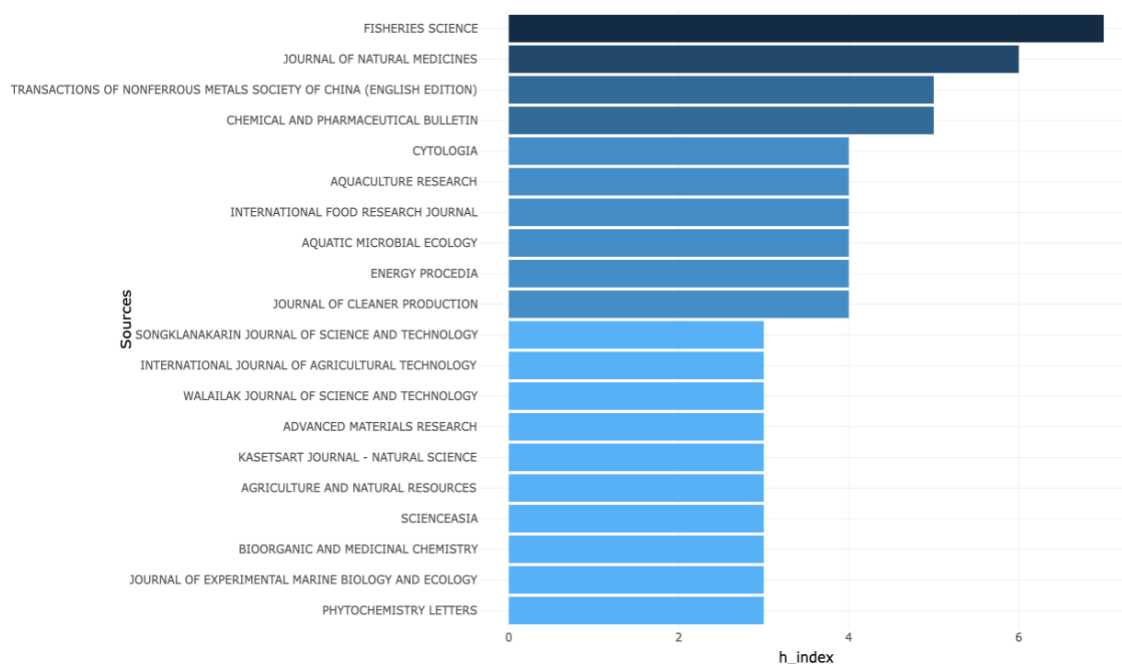
Figure 4 Source Impact

Impact measure

Figure 5's bar graph shows that, among the top 20 influence journals, the Journal of Cleaner Production had the most effect, with about 400 publications, roughly two times more than Nature Journal (220). The International Food Research Journal, Transactions of the Nonferrous Metals Society of China (English edition), and Journal of Natural Medicines were other extremely fruitful sources. In contrast, there are fewer papers in Food Chemistry, Phytochemistry Letters, Energy Procedia, Cytologia, and IEEE Asia-Pacific Conference on Circuits and Systems, Proceedings, APCCAS (with under 50 documents).
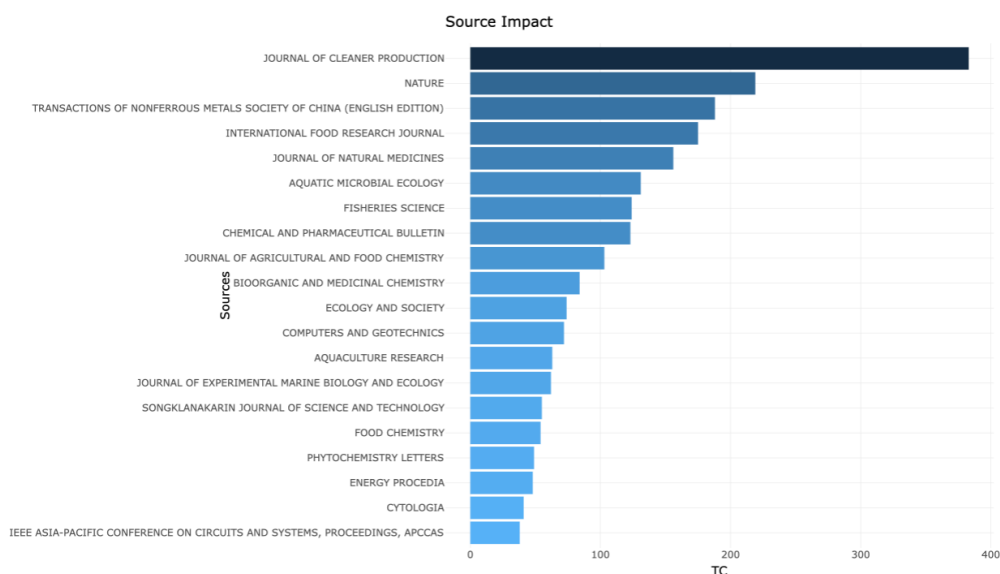
Figure 5 Total citation

Most Relevant Authors

        This horizontal bar graph identifies the authors who were most relevant with fractionalized frequency measure in research.

As seen in Figure 6, Tanyaros, S. (10 articles fractionalized) leads in publication followed by Tongnunui, P., Boonsong, W. and Boonchouytan, W.
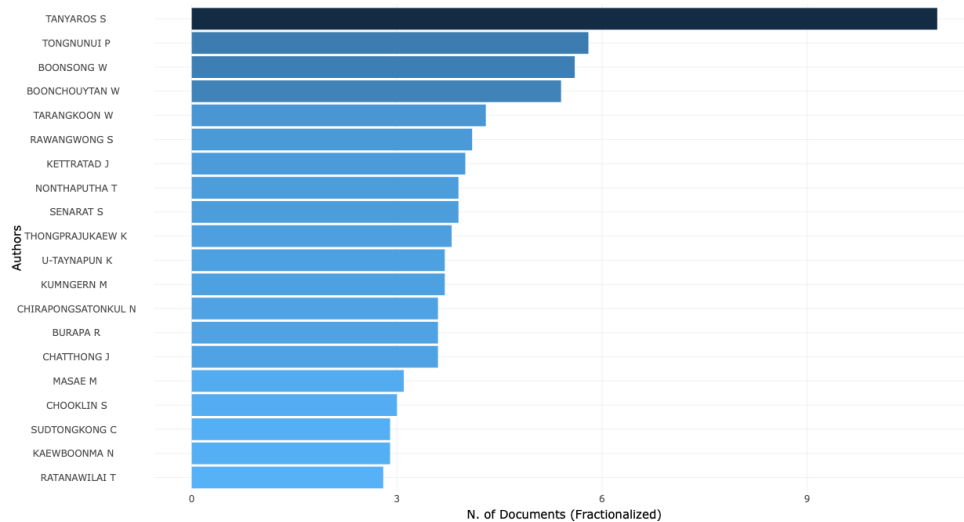

Figure 6 Most relevant authors

2. The Science Mapping Analysis

        Top-Author's Production over the Time

        In 2021, four authors-Kettratad, J., Senarat, S., Jiraungkoorskul, W., and Kaneko, G. dominated the group of authors with a high number of publications, as shown in Figure 7. Pongpiriyadacha, Y., Morikawa, T., Muraoka, O., Ninomiya, K., Yoshikawa, M. and Chaipech, S. were the authors who came in second place among the year 2012 top authors. Additionally, Kettratad, J., Senarat, S., Tongnunui, P., Boonchouytan, W. and Pongpiriyadacha, Y. had the highest production as an author from 2006 to 2022.
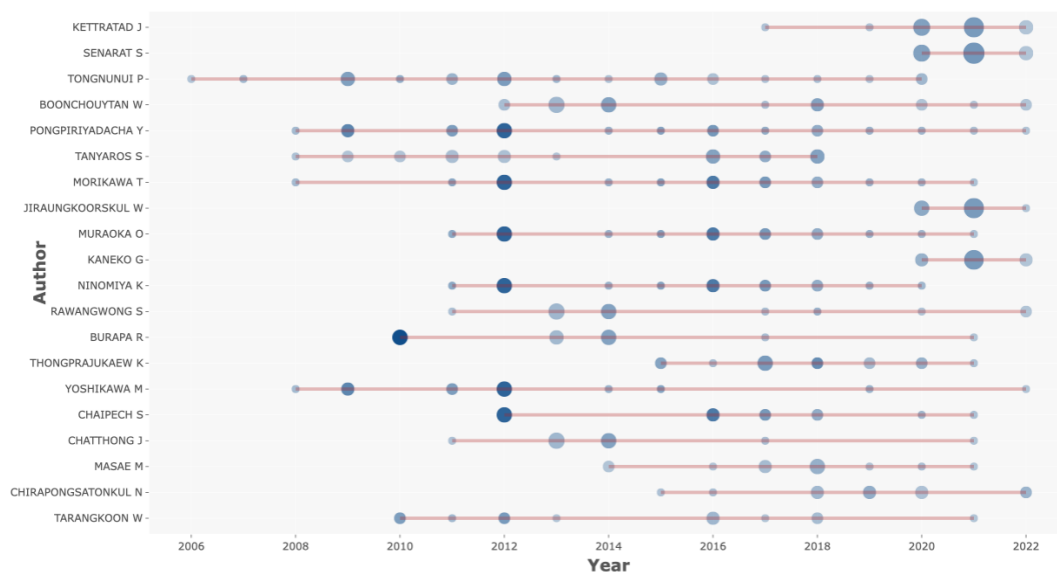

Figure 7 Top-Author's Production over the Time

Trend Topics

The number of keywords appeared in published papers between 2005 and 2022 revealed the various topics of research documents. As depicted in Figure 8, during 2007 and 2009, there are two famous terms used by authors, comprising "eucalyptus" and "spice". Since 2011, the occurrence of words in papers showed the development of themes. It is indicated that the top topics dominated from 2016 to 2018. Regarding this, "Thailand" and "article" were the famous terms in 2016 and 2017 with freq 60.

The next rankings were "animals" and "nonhuman" (freq 48, 2017), "animal" (freq 42, 2018), "controlled study" (freq 41, 2017). After that, the frequency of keywords showed a downward trend in the following years. For instance, in 2021, the highly common themes were "Internet of things", "transmission electron microscopy", "water quality", "wood plastic composite", and "microstructure". However, these terms did not have the same high frequency as previous years.
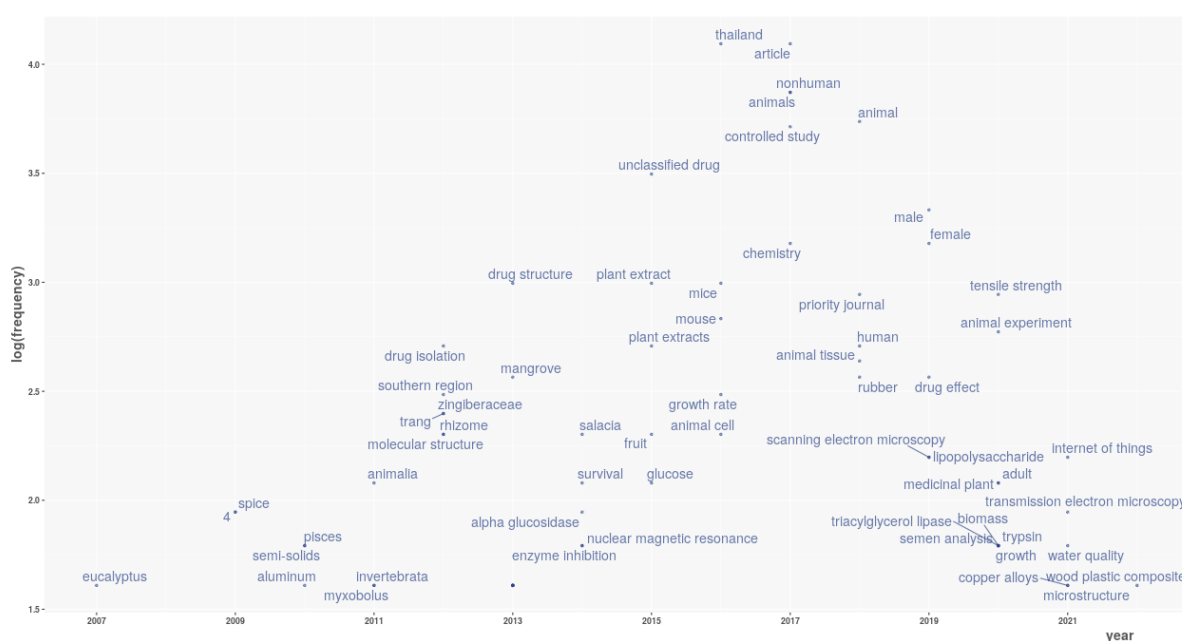

Figure 8 Current research trends

Topics dendrogram

The dendrogram revealed the order and connections of keywords through a hierarchical map. Each term in this map is a collection of topics concerning the research topics which are used by authors in papers in Rajamangala University of Technology. Figure 9 shows the terms divided into two categories with the colors red and blue. The first cluster in blue shows how there are two groups of published papers. The research trends for "mangrove" and "Thailand" were displayed in the first group. The second group

of research topics included "scanning electron microscopy," "Decapoda crustacea," "growth rate," "Internet of things," "tensile strength," and "rubber." Meanwhile, the red cluster was divided into two parts. It is apparent from the first part that the authors' keyword choices were "drug structure," "molecular structure," "drug separation," "plant extract," and "plant extracts." The second part dealt with the relationships between the phrases "animals," "human," "drug impact," "genetics," "gender," and "chemistry."
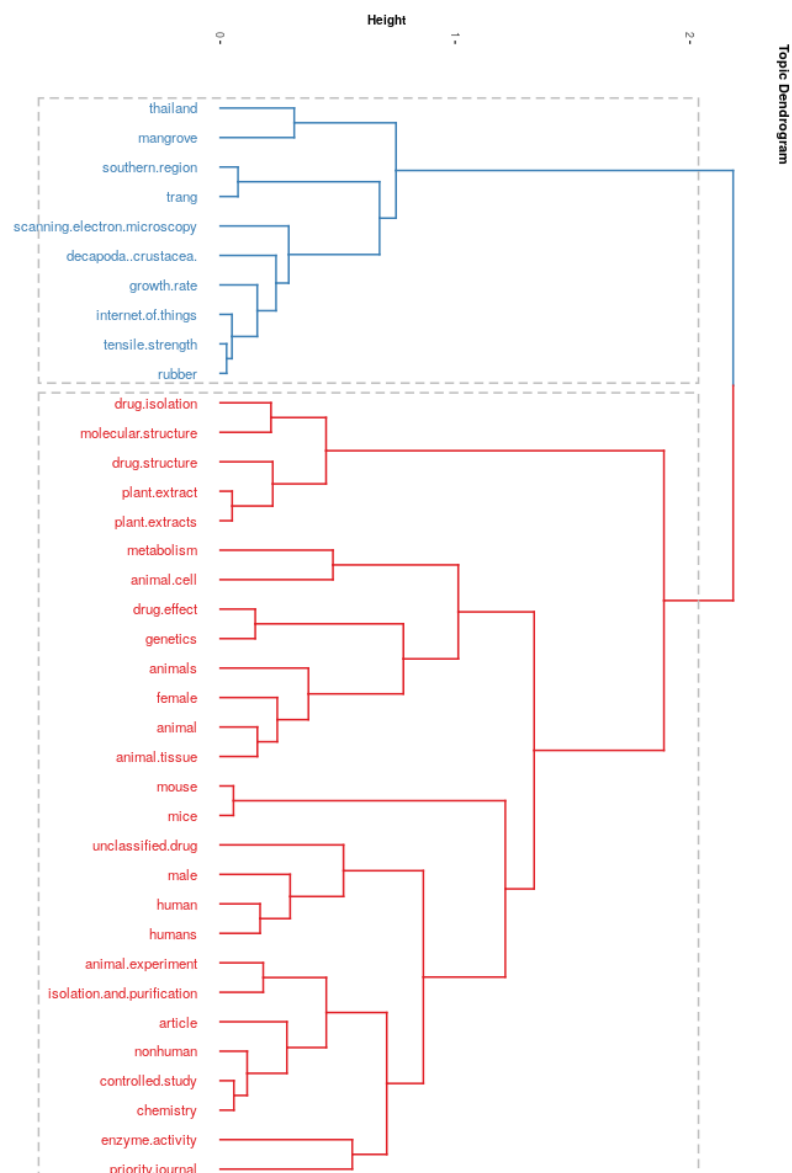
Figure 9 Topics dendrogram

Factorial Analysis

As visualized in the conceptual structure map (Figure 10) with the Multiple Correspondence Analysis (MCA) method, the topics were divided into three clusters of the domain indicated with red, blue and green color. It can be seen from the terms displayed in the domains that each portion expressed all relevant words in the same group. The blue-colored domain contained topics concerning "animal experiment", "animals", "animal cell", "animal tissue", "human", "chemistry", "enzyme activity". The green domain included the connections of keywords of "drug structure", "molecular structure", "drug isolation", "plant extracts". Meanwhile, items in the red-colored domain contained relevant words of "growth rate", "Thailand", "mangrove", "decapoda crustacea", "rubber", "tensile strength", "scanning electron microscopy", "Trang", and "Southern region".
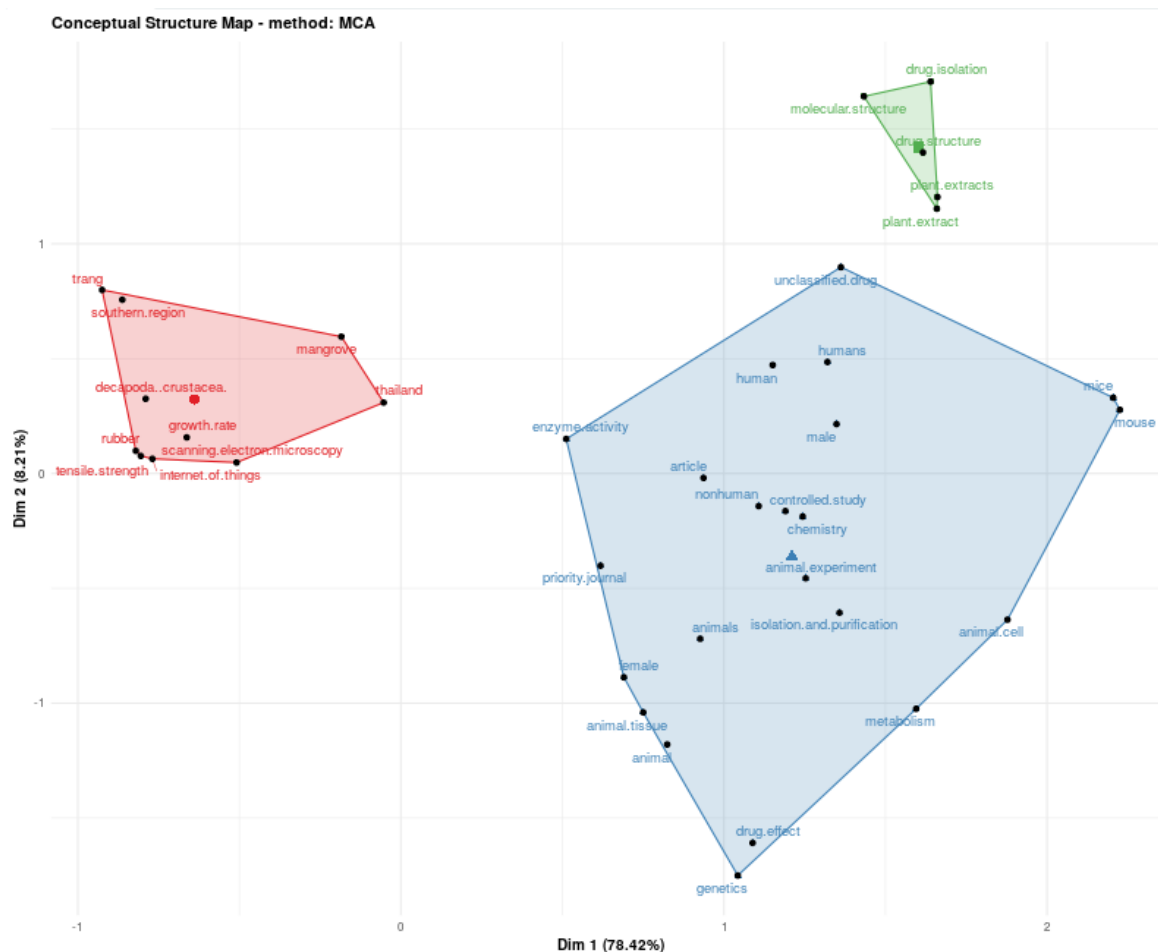
Figure 10 Factorial analysis

3. The Map based on Bibliographic Data

The data of co-authorship analysis in Figure 11 indicate that the top authors have collaborations in publishing papers. The size of the circles expressed the number of publications. The colors represented the co-operation clusters. The top researchers of collaboration network were Kettratad, J., Tongnunui, P., Tanyaros, S., Tarangkoon, W., Thongprajukaew, K., Chirapongsatonkul, N., Sudtongkong, C., Nitiratsuwan, T. and Sangthong, P.
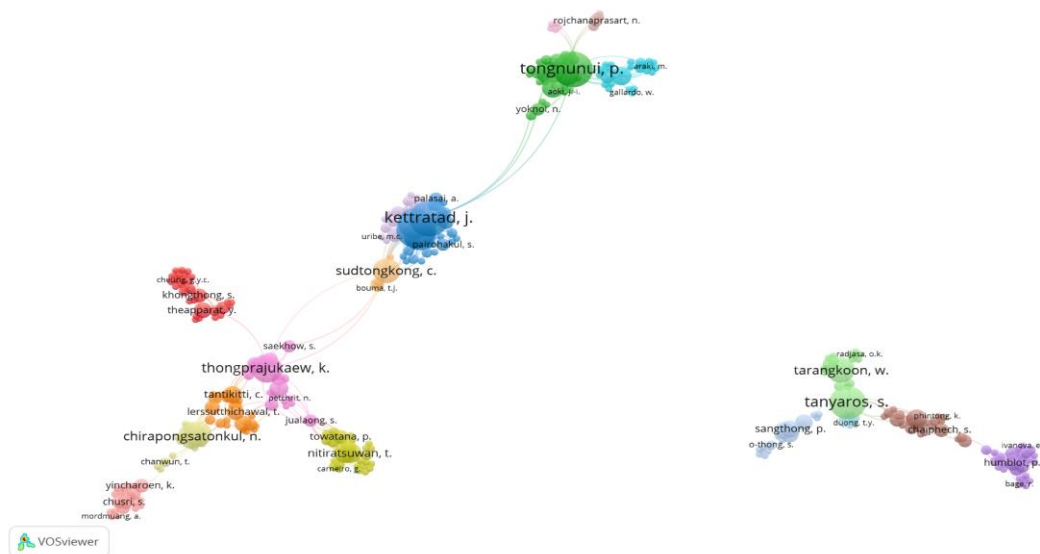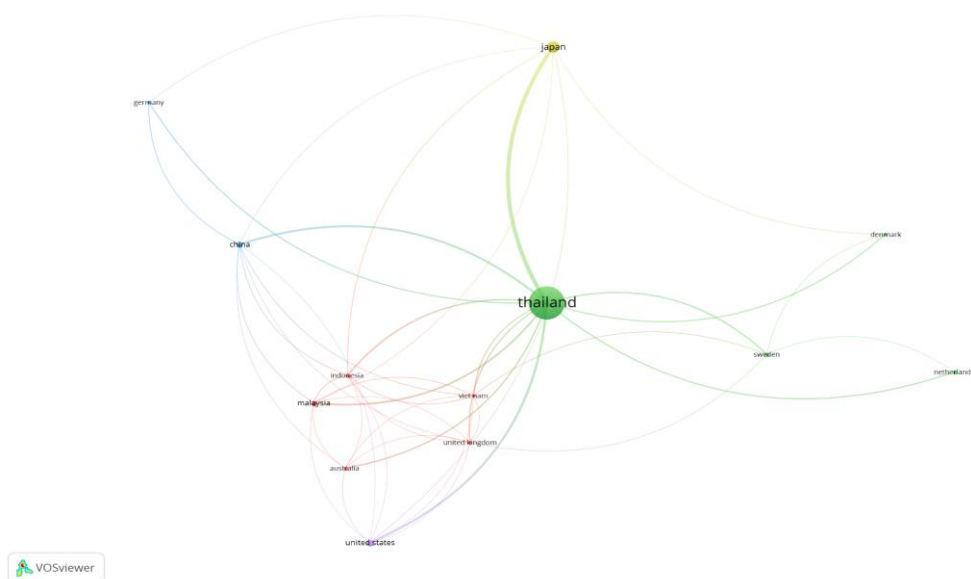
Figure 11 Co-authorship network of authors

Countries

        Figure 12 offers a record of the networking map of collaboration to identify the nations actively working with RUTS. The figure depicted that Japan (67 documents) was a country that collaborates most in publishing research articles, followed by the USA (25 documents), China (18 documents), Malaysia (15 documents), and Indonesia (10 documents). The figure also revealed that many lines were connected to each other in the collaboration network of Thailand. This implies that countries in the European region prefer to collaborate with RUTS when publishing articles in research activities. Most of the countries in Europe were Sweden, United Kingdom, Germany, The Netherlands and Denmark. It demonstrates that collaborations among countries will be able to increase the amount of publications, compared to publications in a single country.

Figure 12 Countries Co-authorship Networks

According to the number of co-occurrence topic frequency between 2005 and 2022, Figure 13 depicts that the similar colors are shown in the same cluster. There are 12 clusters corresponding to distinct colors. The red-colored cluster included the top terms concerning "Thailand", and "animals". The purple-colored cluster contained topics of "unclassified drug", "plant extract".

The keywords of the green-colored cluster consisted of "drug structure", "animal cell", and "zingiberaceae". The old rose-colored cluster was composed of themes relating to "female" and "cattle". The dark blue cluster contained "rubber", "tensile strength", and the lime-colored cluster included topics of "molecular structure" and "chemical structure".
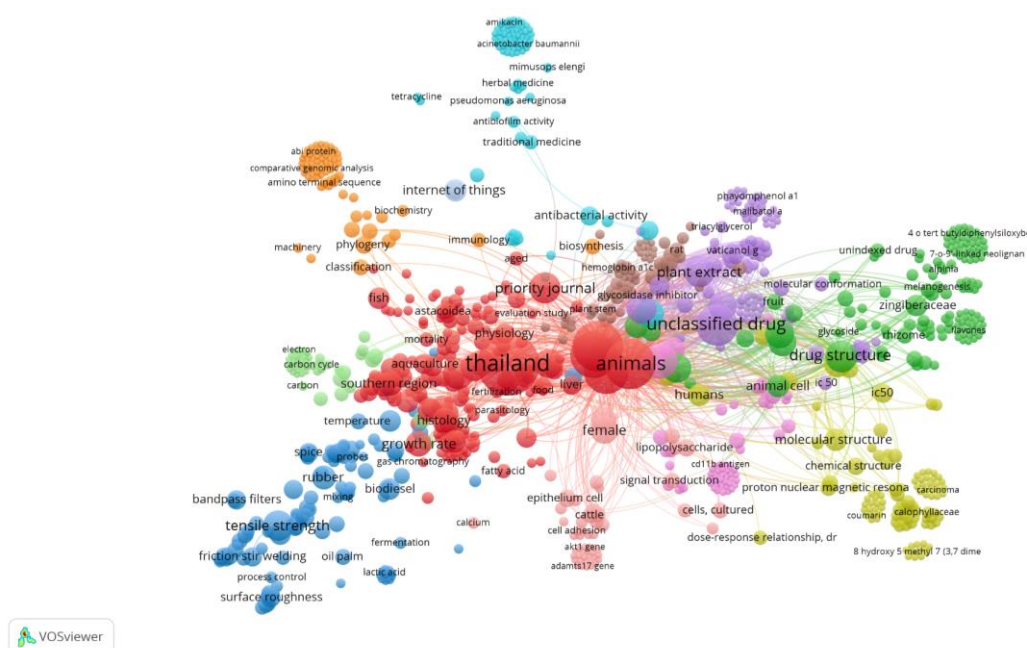
Figure 13 Co-occurrence network map of most frequently used keywords

CONCLUSION

In this study, a bibliometric study based on Scopus database was performed to assess the research productivity of Rajamangala University of Technology Srivijaya during 2005 and 2022. The result reveals that the university has improved an absolute number of overall publications. A notable mention of this research result is that during the years covered in this study the publication rate achieved by RUTS is the fifth compared to the universities in the group of Rajamangala University of Technology. Other interesting result based on this study is that, as mentioned

in the previous section for the scholarly documents recorded in Scopus, the publications in agricultural and biological sciences, engineering, biochemistry, genetics, and molecular biology area give the highest contribution to documents. They actively collaborate with other universities such as Prince of Songkla University, Chulalongkorn University, and Mahidol University. Furthermore, the top three sources that researchers published are Songklanakarin Journal of Science and Technology, International Journal of Agricultural Technology, and Walailak Journal of Science and Technology.

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